

A NOTE ON THE VITALITY OF THE SPORES OF MARSILEA *

BY MARSHALL A. HOWE

In 1888, Professor D. H. Campbell † alluded to the germination of spores of *Marsilea Aegyptiaca*, "in some cases twelve years old." The material with which he worked had been preserved in a dry condition in the Botanical Museum of Berlin, and the spores germinated within thirteen hours after being placed in water. In the course of some remarks on this subject before the Cleveland meeting of the Botanical Club of the American Association for the Advancement of Science, Professor Campbell is reported ‡ to have said that of spores eleven years old, fifty per cent. germinated, and of those five years old, almost all grew. In the *Botanical Gazette* for 1895 (20 : 229), Professor Barnes recorded a still more surprising instance of retention of vitality in the case of the spores of *Marsilea quadrifolia*, which germinated after the sporocarps had been kept continuously for three years in commercial alcohol (95%), the natural inference being that the exceedingly hard wall of the sporocarp is so compact as to resist successfully the penetrating powers of strong alcohol for a period of three years at least.

In May, 1900, for use in a course of laboratory instruction in Columbia University, three or four sporocarps were taken by the writer from an herbarium specimen of *Marsilea quadrifolia* collected by L. M. Underwood and C. R. Barnes, on June 13, 1891, in Fresh Pond, near Cambridge, Mass. (whence, also, the specimens preserved in alcohol by Professor Barnes came). These sporocarps were placed in water after a small portion of the wall of each had been cut away in order to give the water a better chance to penetrate, and they soon burst open, emitting the long gelatinous ring and the attached sori in the way figured

* Read before Section G of the American Association for the Advancement of Science, Pittsburg, July 3, 1902.

† Bull. Torrey Club, 15: 259. O. 1888; Berichte Deutsch. Bot. Gesellsch. 6: 340. 1888.

‡ Bot. Gaz. 13: 235. S. 1888.

in most of the larger botanical text-books. Later, the prothalli were formed, but the spermatozoids were not seen in a motile condition at this time owing to the lack of continuous observation. They were seen, however, in great numbers after the motile period, filling the walls and passage-way of the gelatinous funnel which forms about the female prothallus. In May, 1901, the experiment was repeated with similar results. In May, 1902, a sporocarp from the same material, having then been in the herbarium practically eleven years, was placed in water, and the stages of the resulting germination of the spores were watched more carefully. Swarms of motile spermatozoids were noticed after about fourteen hours, and for eight hours longer a greater or less number could be found in motion. Nearly every spore in the sporocarp germinated. Some of the megaspores were finally removed from the water and kept upon wet filter-paper for ten days, when embryo-sporophytes, with the first leaf a centimeter long, had developed. The remarkable vitality of these eleven-year-old spores naturally suggested that the age-limit for germination had not been reached, and attempts were made to germinate spores from about twenty other specimens of various species which had lain in the herbarium for periods varying from twelve to thirty years. In one of these cases the attempt was successful. This was with material of *Marsilea vestita* preserved in Professor Underwood's herbarium, and collected by Mr. W. N. Suksdorf, in Falcon Valley, Washington, the pocket bearing the double date "Nov., 1883" and "Aug., 1884." The spores were germinated on June 7, 1902, so that even supposing August, 1884, the later of the two dates, to be the correct one for the material used, vitality had been retained for practically eighteen years. Six sporocarps were tried, all of which opened in the normal fashion. Nearly all of the megaspores formed prothalli with archegonia. After fertilization, embryos of considerable size were grown by sowing the spores on damp filter-paper. Of the microspores, practically all showed advanced stages of germination, such as the formation of the prothallus and protrusion of the antheridium, but only about a half of them set free motile spermatozoids. The first free spermatozoids were seen in $11\frac{1}{4}$ hours after the sporocarps were placed in water.

The writer finds no published record in regard to long-continued vitality of the spores of *Marsilea* which equals the case described above, though it is more than probable that a period of eighteen years does not exhaust the possibilities in the matter. Failure in the experiments with spores of greater age is inconclusive as is shown by numerous failures with material of a much less age. It is evident that much depends upon the collection of the sporocarps at just the right stage of maturity.

SHORTER NOTES

A NEW HEMIZONIA FROM CALIFORNIA. — *Hemizonia grandiflora*. Annual: stems erect, branching, 1–3.5 dm. high, glandular-villous and somewhat heavy-scented: leaves all sessile, the lowest opposite, linear-lanceolate, acute, 8–15 cm. long, serrulate and scabrous on the margins, sparsely lanate with very long appressed hairs, those subtending the main branches similar but alternate, those of the floral branches reduced, 1–3 cm. long, obtuse, or the longer ones acutish, glandular-pubescent: heads very showy, 2.5–3 cm. broad: involucre bracts broadly lanceolate, subacute, 6–7 mm. long: rays 8–10, 10–12 mm. long, 7–9 mm. wide, 3-lobed to near the middle, the lobes obtuse, the middle one about half as broad as the outer ones and somewhat shorter, pure white or the midveins of the lobes pinkish beneath; disk corollas glabrous without, their lobes ciliate within toward the apices: outer bracts of the receptacle united into a cup: achenes black, very shortly stipitate, obovate, smooth, rounded on the back and faintly keeled, 2.75 mm. long, 1.5–1.75 mm. broad.

This species is closely related to *H. luzulaefolia* DC., but differs from that species in having much larger heads, involucre bracts and achenes, and greener foliage. The conspicuous lanate leaves are confined to the base in *H. luzulaefolia*, while in this species they extend up on the stem and subtend the main branches. Finally, *H. luzulaefolia* is a late summer and autumnal species, while this is in full bloom in the middle of May and will have fruited and gone before that species begins to flower.

Crystal Springs Lake, San Mateo Co., California. Growing on hillsides which are composed of serpentine rocks. Collected by the writer (no. 2446) 11 May, 1902. LEROY ABRAMS.